

## Leak Prevention

## Tanks Down East

by W. David McCaskill

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## Taking the Pulse of Maine's CP Tanks

**T**here was a time when cathodic protection (CP) was relegated to preventing major engineering projects such as bridge pilings or interstate pipelines from rusting to pieces. On the consumer side, cathodic protection was used to prevent outboard motors or hot water heaters from rusting to pieces. The former CP systems were project-specific designs for high-risk projects, while the latter were pre-engineered systems for consumer uses. Major structures were usually monitored carefully by professionals over the life of the structure, while the consumer goods—let's face it—were sold, and that was that. In the case of cathodically protected USTs, we have some sort of CP hybrid—high-risk structures with pre-engineered systems that generally get little attention.

### The Life and Times of CP in Maine

In Maine, we have 1,812 cathodically protected steel USTs—roughly one-third (31%) of our total population of 5,900 active USTs. Most of these tanks were installed with pre-engineered galvanic CP systems, where the number and size of the sacrificial anodes (zinc or magnesium bars that provide the flow of electrical currents around the tank and protect the tank from corrosion) have been selected and connected directly to the tank rather than installed in the field.

Galvanic CP systems are relatively simple in construction and operation, but it is widely acknowledged that their effectiveness must be monitored over time. This monitoring is relatively easy to accomplish by measuring the electrical potential

(voltage) of the tank relative to a standard reference cell (usually a copper/copper sulfate reference electrode).

Since 1985, Maine has required that cathodically protected steel tanks be tested annually by certified tank installers (CTIs), who are required to demonstrate a minimal competency in CP by passing a certification exam that includes some questions concerning CP. (Corrosion professionals who are not CTIs but want to test tanks can obtain separate cathodic protection tester certification.) CTIs must periodically attend

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industry-sponsored refresher seminars on CP testing and troubleshooting as a part of maintaining their certification.

For the past six years, the Maine Department of Environmental Protection (DEP) has mailed annual CP test reminders to tank owners. This mailing includes a log sheet to help remind tank owners that records of their CP test results must be kept on file for a minimum of three years. Because tank owners are not required

to submit the results of this monitoring to DEP, little data has been available to the agency on how the CP systems or the storage tanks were faring. However, as the tank owners got around to contacting the CTIs and having their CP systems tested, the DEP began to see some problematic trends.

### Stop the Madness

For years we have grappled with a number of issues associated with cathodically protected tanks—continuity problems with leak detection devices and electrical conduits; CTIs looking all over the site for that elusive passing reading; and even plain old falsification of CP readings.

Finding a qualified and interested contractor has become a rarity. Many times the CTIs just aren't interested in getting involved with in-depth troubleshooting for a CP problem (or the owners aren't willing to pay for the work), or they don't feel that they have the expertise to properly troubleshoot failing systems. Added to this is our suspicion that a large number of tank owners, especially "consumptive use" tank owners, have never had their tanks tested.

With our CP data suspect, our CP testing requirements suspect, and our CP compliance rate unknown, we decided it was time to stop the madness and take the pulse of our CP tanks and the way in which we assured compliance. We hired an engineering consulting firm to test a sample population of CP tanks in the state.



We set out to answer the following questions:

- What is the compliance rate for the annual CP testing requirement?
- Are our current test procedures adequate to determine the CP status of these tanks?
- Are any categories of tanks (e.g., size, age, manufacturer) more prone to CP failure than others?
- Should the state's annual CP monitoring procedure be modified to improve its effectiveness?

## The Methodology

From a practical point of view—travel, logistics, cost—we decided that testing 75 randomly selected sites would be “doable” in a single field season. As it turns out, the study involved a total of 134 tank tests at 73 facilities. In terms of tank types, we had 68% motor fuel, 30% fuel oil, and 2% new/used oil. Because most of these facilities did not have cathodically protected steel piping, the study was limited to CP tanks.

Our current regulations allow for a single-point CP reading. For the purpose of the study, however, we decided to evaluate the tanks using a multiple measurement protocol—taking a reading along the top of the tank at the middle and both ends. This method would provide a better measurement of the protective current around the whole tank and thereby address dead spots in the CP current.

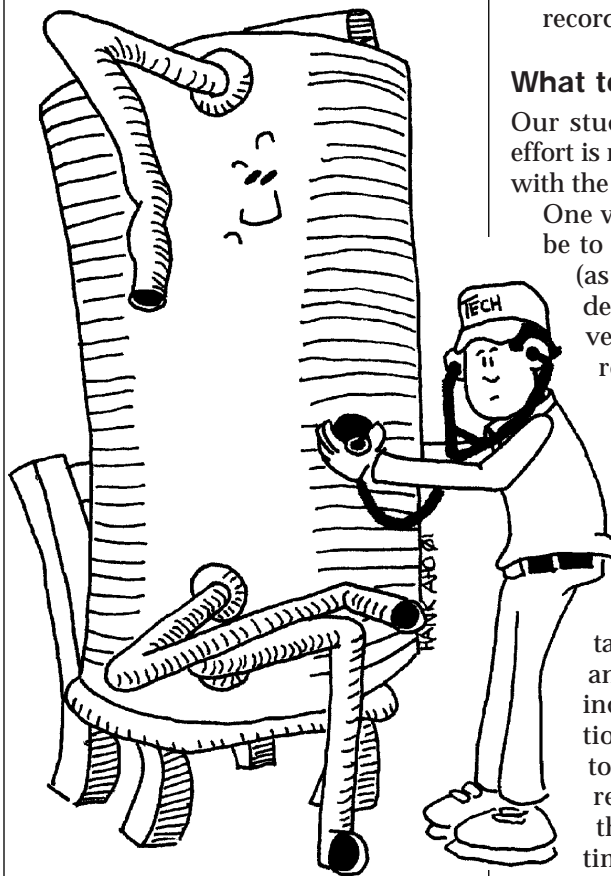
Past industry practice has been to take a single measurement in the middle of the tank over the centerline. This location is considered the most conservative because it is equidistant from the anodes on the end of the tank and thus the farthest from their protective current. However, recent information from trade journals and the National Association of Corrosion Engineers (NACE) suggests that multiple readings are a more prudent way of determining the adequacy of CP readings.

Multiple readings meant that our consultant had to find additional access to the soil over the tank. At times, small holes ( $\frac{1}{2}$ -inch diameter) would have to be drilled in pavement and concrete to access the soil (using a thin “pencil” reference electrode).

We've heard stories about contractors in other states, who when faced with the soil access problem, simply take a reading through concrete over the tank. Readings through the concrete pad, rather than the soil, almost always gives a false reading in favor of passing the tank.

## The Results

- Of the 134 tanks tested, 78 tanks (58%) met the study criterion of three readings; 17 additional tanks (13%) met the less stringent DEP



criterion of one passing reading. Thirty-nine tanks (29%) did not meet any criterion for cathodic protection.

- Using DEP's single-reading criterion, CTIs passed 91% of the tanks they tested. Using the same criterion, the pass rate for the study was only 71%.
- Many of the manufacturers of the tanks tested during the study were unknown, so no relationship could be drawn between CP performance and manufacturer.
- There was no significant relationship between the age of the tank and cathodic protection status.

- Only 44% of the tanks that passed the study criterion were 6,000 gallons or greater; 73% of tanks less than 6,000 gallons passed the study criterion.
- Limited electrical continuity testing was performed on 42 failing tanks. Thirteen (31%) of these tanks had continuity problems.
- As far as compliance is concerned, 20 (27%) tanks had no CP testing records, 14 (19%) had one year of records, 24 (33%) had two years of records, and only 15 (21%) had the required three years of CP records.

## What to Do?

Our study made it clear that more effort is needed to ensure compliance with the annual CP test requirement.

One way we could do this would be to make successful CP testing (as well as the annual leak detection spill and overfill prevention testing) a condition for receiving fuel. We currently have a bill in the legislature to address this. We'll see how far that goes.

Regarding testing requirements, we agree with the study recommendations that the three tests over the top of the tank (one reading on each end and one in the middle) be incorporated into our regulations. The next step would be to also include specific requirements that spell out the corrective actions and timetable for repair of tanks that have failed the CP test.

Regarding CP testers, the report recommends that those still interested in dealing with CP tanks go through a separate certification process with more rigorous training on testing, troubleshooting, and repairing CP systems. Training should be hands on.

One of our greatest concerns is what to do about the 29% CP systems lurking out there that are likely to fail the test. Some CP systems may be fixed easily by adding additional anodes (see STI publication #R972-98), but others may require the installation of an impressed current system to protect the tanks.

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Because the price tag for an impressed current system could run up to \$7,000, a financial package should be developed to assist mom and pop businesses faced with the sticker shock. We have already proposed a change to our statute that would allow the Finance Authority of Maine to make such loans for CP as well as leak detection, spill, and over-fill repairs and retrofits.

Finally, the study recommends that we undertake a long-term study of CP tanks that are removed to perform, in essence, a tank autopsy. With more and more CP tanks being removed this could prove to be an interesting study. The implementation of this recommendation is still uncertain because of the logistical concerns.

### What Did We Learn?

Our CP study provided us with the basis for making some key improvements in how we regulate and enforce our CP tanks. In a nutshell, this is what we learned:

- We need to tighten up compliance so that all CP tanks are tested routinely.
- We need to tighten up our testing protocol so that we can rely on the testing data.
- We need to teach CTIs more about CP testing, especially troubleshooting techniques, so that they can be more helpful to tank owners with failing tanks.
- Galvanic CP systems are relatively simple. If tank owners and CP testers are having trouble with these systems, we can only wince at the thought of them having to deal with impressed current systems, which may become more common as the galvanic systems are repaired. ■

***The complete report can be found  
on our homepage at  
[http://janus.state.me.us/dep/  
rwm/publications/cpreport.htm](http://janus.state.me.us/dep/rwm/publications/cpreport.htm).***